Functionally expanded phase-change memory: Experiments on light influence on threshold voltage

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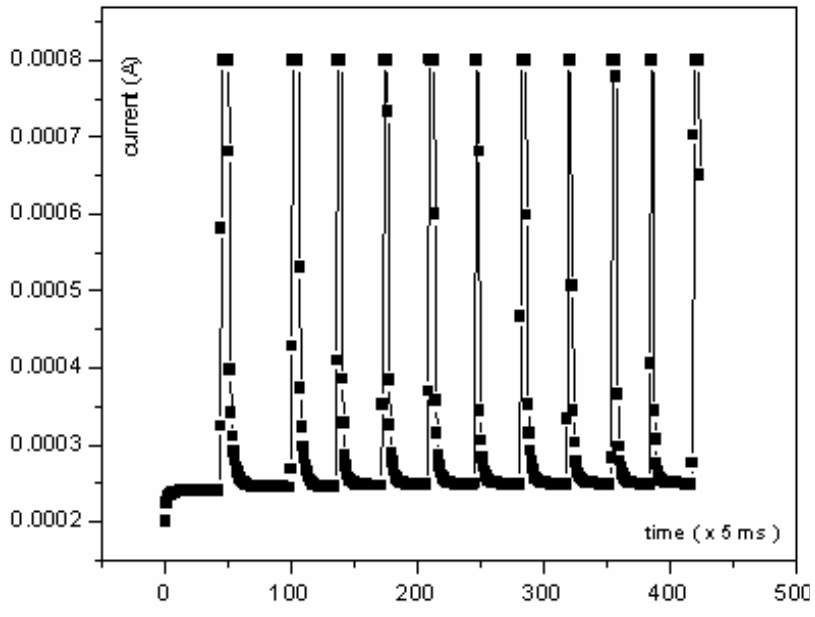
Phase change memory (PCM) based on amorphous chalcogenides is considered as a promising replacement for existing non-volatile memories. Additional PCM advantage is possibility to expand functionality beyond traditional area. One of the most promising applications, the creation of hybrid optoelectronic memories, was limited by non-sensitivity of SET-RESET transition to light in traditional amorphous chalcogenides [1].
We figure out that this obstacle can be removed in some specially selected ternary chalcogenide glasses. Initial experiments on light influence on threshold voltage (V_t) with lead-contained amorphous films allow to achieve technically acceptable level [2]. In this paper we describe first experimental results with new ternary lead-free telluride compound (further labeled as SA1). More than 10,000 switching cycles without degradation have been recorded in SA1 illuminated by 177G42 Ar ion laser operated at 514 nm through a mechanical chopper (frequency 0.5 Hz). The typical result is shown in the figure 1 for constant applied voltage to the SA1 cell equal to 66% of dark V_t and SET state current limited to 0.8 mA. Variation of the laser power allows to achieve V_t reduction in SA1 down to 40% from the dark level. This is the largest change of V_t known for amorphous chalcogenides. Some ideas about the mechanism of the observed effect related with the photo-generation of charge carriers and possible mechanisms of transition from RESET state to SET state will be discussed. Hence, we demonstrated that some ternary amorphous tellurides can be used for functionally expanded phase change memory. It opens new horizons for chalcogenide non-volatile memories applications.



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